

Ascension to utilise the late opposition will be on this account awaited with much interest. Nevertheless, whatever degree of opinion might be entertained by competent authorities, it appears to have been felt by those immediately responsible for action, in different civilised nations where science is encouraged, that so rare a phenomenon as a transit of Venus could not be allowed to pass without every exertion being made to utilise it, and this country may lay claim to an honourable share in the great scientific effort, thanks mainly to the long-continued and admirably-directed endeavours of the Astronomer-Royal to secure this result.

Several of the stations occupied during the transit of 1874 will be available for the transit of 1882, Kerguelen's Land in particular, where at Ingress the sun will be at an elevation of 12° , the factor of parallax being 0.98. In that year there will also be the advantage of observations along the whole Atlantic sea-board of the United States and Canada, where, as pointed out by the Astronomer-Royal in 1868, the lowest factor is 0.95, and the smallest altitude of the sun 12° for observing the retarded Ingress; and for observing the Egress as accelerated by parallax, the factors are about 0.85, the sun's elevation varying from 4° at Halifax, to 32° at New Orleans, or Jamaica. Australian and New Zealand stations are important for retarded Egress.

As is well known, the transit of Venus on December 6, 1882, will be partly visible in this country.

PARKER AND BETTANY'S "MORPHOLOGY OF THE SKULL"

The Morphology of the Skull. By W. K. Parker, F.R.S., and G. T. Bettany, M.A. (London: Macmillan and Co., 1877.)

IN the minds of most of those who have paid no special attention to the subject the skull is regarded as a bony case formed to contain the brain, together with the face. There is also a constancy in the number and position of these bones which lead to the apparently necessary conclusion that occipital, sphenoid, parietal, and other elements are fundamental cranial structures; so that an exhaustive study of their relationships and variations might be thought entirely to cover the subject of skull structure.

That such is not the case has dawned upon us since the elaborate researches of Rathke and other able embryologists, among the foremost of whom must be placed Profs. Huxley and Gegenbauer, who have been followed by Mr. Parker, the author of the work under consideration, who on account of his peculiar aptitude for manipulation, his untiring zeal and his immense experience, has placed the subject of cranial morphology upon a footing infinitely more satisfactory than it has previously been. His numerous memoirs in the *Transactions* of the Royal, Zoological, and Linnean Societies form a mine of biological facts, so beautifully supplemented by their accompanying illustrations. The perusal of them all, in their proper sequence, is however a task only to be undertaken by the specialist, and it is on this account that we have no small degree of pleasure in being able to give a notice of "The Morphology of the Skull," a work of less than four hundred pages, in which is collected, condensed, and

digested the mass of information spread through the larger memoirs.

The work consists of a series of chapters on the skulls of carefully-selected types of the five classes of the Vertebrata. Those chosen are:—

1. The Dog-fish and Skate.
2. The Salmon.
3. The Axolotl.
4. The Frog.
5. The Common Snake.
6. The Fowl.
7. The Pig.

These are each described in all stages from their earliest appearance in the blastoderm to their adult condition. Following each chapter is a brief *résumé* of the peculiarities which have been observed in other members of each group, in such a manner that the student of any particular form can learn almost all he may require with reference to any special member of the sub-kingdom.

The primitive trabeculæ cranii, together with the parachordal cartilages and the branchial arches are traced from their earliest development until ossification in and around them has reached the limits of the different types. The insufficiency of our data for the determination of the cranial segments is prominently brought forward, although the moniliform constrictions of the anterior extremity of the notochord in the fowl and in the urodeles is stated, and thought to suggest a segmentation. On the subject of the vertebral theory of the bony skull, Mr. Parker tells us that "only one bony segment, the occipital, can be said to be clearly manifest in the skulls of fishes and amphibians. And in these forms there are no good grounds for assigning to the cranial bones special names indicating a correspondence to particular parts of vertebræ. From the study of adult structures in the mammalian groups skull-theories have been devised, lacking the basis of embryology; and granting that they express some of the truth respecting the highest forms of skull, there is only injury to knowledge in arbitrarily interpreting the lower forms by them. In reptiles the skull becomes much more perfect, but with wide variations in the different groups, such that they cannot be merely subordinated to and explained by the mammalian type. A careful study of the growth of the bird's skull, again, will show that it is impossible to express its composition on a simple formula derived from vertebral structures. But from the lower to the higher forms of vertebrates we can discern a growing away from the primordial type of skull towards and into a loftier development." This result of the extensive investigation upon which it is based is somewhat paradoxical. The "loftier development" of the highest types results in a skull some of whose components may be compared in detail with some expression of truth to vertebræ, whilst in the lower forms a similar comparison cannot be said to hold. And yet true vertebræ themselves, fully developed as far as their essential details are concerned, are found in forms far from high in the scale.

Mr. Parker's invaluable investigations besides their importance in a comparative anatomical point of view, have done much to demonstrate the degree of stress which must be laid on facts of cranial structure in problems relating to classification. His labours have led him to elaborate the instructive classification of birds

promulgated by Prof. Huxley in 1867, and so to bring out many points of special interest in avian cranial osteology, demonstrating most clearly the principle which may be arrived at from the study of any special organ or single structure, that a fact which is of the greatest significance in determining the relationships of some one collection of species or genera, may be valueless in attempting to classify others. As an instance of this we may take the skull of the woodpeckers and wrynecks, the peculiarities of which have led Mr. Parker to place them in a division by themselves of primary importance, whereas there is nothing more certain than that their differences from the Toucans and Capitonidæ are only just sufficient to separate them as a family from either. And yet among almost all other orders of birds the cranial structure is invaluable in the determination of their affinities.

The uniformity of the nomenclature and the absence of any laxity in the expression of the mutual relations of parts, greatly increases the facility with which the great number of facts brought forward by the authors can be grasped, and no doubt it is Mr. Bettany whom we have in great measure to thank for the general selection and classification of those which have been chosen to form "The Morphology of the Skull."

In conclusion we feel certain that all who read the work under consideration, the very nature of which makes it almost impossible for us to discuss the details with reference to any of the points which it brings forward, will realise how important an addition it is to biological science, and no thinking student will lay it down without recognising how much scope there is for still further investigation in the same field, especially in that direction which leads to the explanation of the reason why cartilages grow and bones form in certain definite directions and situations and in them alone; in other words, the next book of the kind required is one on the dynamics of the development of the skull.

THOMSON'S "SIZING OF COTTON GOODS"

The Sizing of Cotton Goods. By Wm. Thomson. (Manchester: Palmer and Howe.)

IN weaving cotton cloth it is necessary that the warp, which has to withstand a considerable strain in the process of manufacture, should be artificially strengthened by "sizing," that is, by dressing the thread with some adhesive material so as to enable it to resist the pulling and wearing action of the healds and shuttle. In the earlier days of cotton manufacture the weaver contented himself with the use of a mixture of flour-paste and tallow; the first ingredient gave the thread the desired extra strength, the second removed the harshness which the use of flour alone would have given. But the manufacturer soon discovered that by a judicious selection of the components of his "size," and by alterations in the mode of applying it, he could confer upon the cloth the appearance of being fuller and stouter than it actually was, judging from the amount of cotton contained in it. The great scarcity of the raw material during the cotton famine which sprung out of the American civil war had a powerful effect in developing the ingenuity of a certain set of manufacturers, and there is no doubt that their machinations have had a lasting influence upon the mode of manufacture of grey

cloth. As the weight of a piece of calico is one of the chief elements in determining its value, attempts were quickly made to increase that weight by mixing such bodies as powdered heavy-spar, or, worse still, of deliquescent salts like the chlorides of magnesium and calcium, with the sizing material. Occasionally the manufacturer in thus attempting to palm off water or a worthless mineral in lieu of good cotton over-reached himself and a just retribution overtook him in the shape of heavy damages for mildewed or rotten goods.

The results of many of these attempts afford excellent illustrations of the proverbial danger of a little knowledge; the manufacturer somehow acquired the information that chloride of calcium, an almost worthless bye-product in many chemical operations, was an excellent absorbent of atmospheric moisture; its advantages as an ingredient of the sizing mixture were therefore obvious; unfortunately he knew nothing of *oidium oranteacum* or *puccinia graminis*, and had probably never heard of *penicillium glaucum*, or he might have known that he was preparing a mixture specially suited to the development of these fungi. Silicate of soda or water-glass doubtless appeared at first sight to be an excellent substance for dressing warp, but a painful experience was needed to teach some manufacturers that these alkaline silicates rapidly absorb carbonic acid, and that the resultant products, namely, free silica, and sodium carbonate, together occupying a larger volume than the original silicate, exerted a disruptive action upon the hollow cotton-fibre and made the cloth rotten and useless. Mr. Thomson does not altogether shirk the consideration of the moral aspects of the question of sizing; he makes no secret of the fact that the operation is often done with fraudulent intention. He expresses his opinion distinctly enough that the introduction of an undue amount of size into goods intended for the home trade can serve no useful purpose, but we think he will find it difficult to convince ordinary or unbiased people that a composition consisting, to the extent of half its weight, of a mixture of putrid flour, or British gum, China clay, barytes, or magnesium chloride, tallow, or palm-oil, with a sufficient amount of chloride of zinc or carbolic acid to prevent the whole from running into absolute nastiness, is a fit material to clothe even the patient Hindoo or the prudent Chinaman. Mr. Thomson, however, takes this business of sizing as a fact which, of course, cannot be ignored, and he tries to make the best of it. In the outset he shows that, as it now stands, the process is one of the clumsiest, most unscientific, and least understood of all the operations with which the manufacturer has to deal, and he points out, clearly and concisely, wherein it is faulty, and how it may be amended.

The book is, of course, designed primarily for the use of grey-cloth manufacturers, calico-printers, and generally of those whose business it is to buy and sell calico; and the subject is mainly treated from the point of view of a chemist perfectly familiar with the objects sought to be gained by legitimate sizing. In plain and albeit scientific language he describes the various pieces of apparatus employed in ascertaining the value of the different ingredients in size; he points out the qualities, good and bad, of the materials employed to give adhesive and softening qualities to the size; how the